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Patent, Trademark, and Copyright Causes

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August 30, 2000

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Honorable Commissioner of
Patents & Trademarks
BOX APPLICATIONS - FEE
Washington, D.C. 20231

Re: Patent Application for:
AIRCRAFT IGNITION CABLE CONNECTOR
Applicant: Howard R. Johnson
Our Docket No. R061-P

Sir:

Enclosed herewith please find the patent application, above-referenced, accompanied by a Declaration and Power of Attorney fully executed by the applicant, Howard R. Johnson, as well as an executed Statement Claiming Small Entity Status- Independent Inventor, and a check in the sum of $345.00 representing the filing fee for a patent application filed on behalf of a small entity.

If, for any reason this fee in insufficient, please debit our Deposit Account Number 02-1731. A duplicate copy of this letter is enclosed for this purpose.

Respectfully submitted,

BEEHLER & PAVITT

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Encl.

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STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR

Docket Number (Optional): R061-P

Applicant,Patentee, or Identifier: HOWARD R. JOHNSON

Application or Patent No.: _____

Filed or Issued: Filed herewith

Title: AIRCRAFT IGNITION CABLE CONNECTOR

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- [X] the specification filed herewith with title as listed above.
- [ ] the application identified above.
- [ ] the patent identified above.

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Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- [X] No such person, concern, or organization exists.
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Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
HOWARD R. JOHNSON		
Signature of inventor	Signature of inventor	Signature of inventor
Aug. 24, 2000		
Date	Date	Date

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Attorney Docket:R061-P

In re Application of:

HOWARD R. JOHNSON

Serial No. New Appl'n

Filed: Herewith

For: ***AIRCRAFT IGNITION CABLE CONNECTOR***

Honorable Commissioner of Patents & Trademarks
BOX APPLICATIONS - FEE
Washington, D.C. 20231

EXPRESS MAIL CERTIFICATE

"Express Mail" Label number EL680358762
Date of Deposit: August 30, 2000

I hereby certify that the attached paper and/or fee as identified below:

Patent Application, above-referenced, with fully executed Declaration and Power of Attorney, Verified Statement Claiming Small Entity Status, and check in the sum of $345.00 representing filing fee and two copies of transmittal letter are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to:

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BOX APPLICATIONS - FEE
Washington, D.C. 20231

Esther Miller

Dated: August 30, 2000

Aircraft Ignition Cable Connector

Field of Invention

The invention pertains to high voltage ignition cable connectors. More particularly, the invention relates to moisture proof connectors for spark plugs used in piston-type aircraft engines.

Background of the Invention

Various types of high voltage ignition cable connectors have been developed for use in aircraft engines. U.S. Patent No. 4,150,865 issued to *Iliff* discloses a spark plug connector including a threaded cap through which the high-tension lead passes. The cap threadedly engages an externally threaded metal cylindrical barrel encasing the spark plug insulator and contact. A coil spring and compressible tubular grommet, held in place by the cap, serve to seal the cable end and spark plug against moisture while providing a secure contact between the cable and the contact.

U.S. Patent No. 2,109,030 issued to *Nowosielski*, is directed to an ignition apparatus and relates to spark plugs of aviation engines. The intent is to enclose all parts of the spark plug system so that high-tension current-carrying systems are protected and shielded so as to prevent interference with reception of radio signals. Insulating material covers the ignition wire with an outer metallic sheath. A swivel connection is soldered to the sheath which is detachable from a coupling nut, all of which provide the necessary protection.

U.S. Patent No. 3,334,326, issued to *Bedsore et al.* is directed to a moisture proof connector for spark plugs associated with internal combustion engines. The moisture proof connector of this reference is especially useful in aircraft type engines that are susceptible to

fouling due to the accumulation of moisture and dirt in the spark plug well. The insulated cable and grommet is a wire-meshed reinforced insulated conduit that is fastened to the upper end of the metal ferrule. The conduit, with its wire-meshed construction provides for the flexibility necessary in order to protect the cable.

U.S. Patent No. 4,978,309 issued to *Straub* describes an igniter cable connector that is used in the high voltage electrical systems of an aircraft engine. The patent is intended to avoid flashover between the igniter insulator and the connector insulator and is accomplished by introducing a resilient seal between the insulators. In a first embodiment of the invention, a resilient annular seal is positioned on an end of the connector insulator adjacent to and surrounding the contact. The seal engages the contact as well as the insulator end and the wall of the igniter insulator bore end section. The seal has sufficient resilience to permit insertion of the seal into the igniter insulator bore without interference with the attachment of the connector to the igniter.

U.S. Patent No. 2,312,757 issued to *Frei* discloses a radio shielded ignition apparatus, particularly to the connecting means for high-tension conductors in order to provide radio-shielded ignition circuits for internal combustion engines. The patent provides for the connection of the electrode with a source of high tension current by means of an insulated conductor. The conductor is shielded to prevent interference by means of a flexible metallic conduit along with a rigid metallic elbow wherein the conduit and elbow are connected together by a ferrule that telescopically receives the adjacent ends thereof.

While other variations exist, the above-described designs for aircraft ignition cable connector are typical of those encountered in the prior art. It is an objective of the present invention to provide a securely fastenable aircraft ignition cable connector that provides

superior shielding for radio-frequency signals from high voltage ignition noise. It is a further objective to provide such shielding in a connector that provides complete sealing against moisture and dirt found in the aviation environment. It is yet a further objective to provide a connector with a flexible elbow tube that may be easily formed to a variety of required configuration without the use of special tools. It is an additional objective of the invention that the flexible elbow tube be capable of retaining its shape once formed, to simplify installation after spark plug service. It is a final further objective of the invention to provide the above described capabilities in an inexpensive and durable connector which is capable of extended duty cycles.

While some of the objectives of the present invention are disclosed in the prior art, none of the inventions found include all of the requirements identified.

Summary of the Invention

The present invention addresses all of the deficiencies of prior aircraft ignition cable connector inventions and satisfies all of the objectives described above.

An aircraft ignition cable connector of the present invention may be constructed from the following components. A radio-shielded ignition cable is provided. The cable has an outer insulating cover, a shielding conductor, an inner insulating layer, and a center conductor. A flexible, conducting, elbow tube is provided. The elbow tube has a first end and a second end and is fixedly and conductively attached at its first end to the shielding conductor of the cable. The elbow tube is capable of retaining a particular shape after bending.

A sealing sleeve is provided. The sleeve joins the outer insulating cover to the first end of the elbow tube. A threaded nut is provided. The nut has a central orifice through it, a

first end, a second end, a retaining lip at the first end and an internal thread extending from the second end toward the retaining lip. A conducting ferrule is provided. The ferrule being cylindrical in shape, having a central orifice though it, and having a body portion and a retaining portion.

The body portion has a first end and a second end and is sized and shaped to fit slidably through the orifice in the threaded nut. The body portion is fixedly and conductively attached at its first end to the second end of the elbow tube. The retaining portion has a first end and a second end. The first end extends from the second end of the body portion and is sized and shaped to bear rotatably against the retaining lip of the threaded nut. The second end of the retaining portion includes a cylindrical recess.

A coil spring is provided. The coil spring has a first end and a second end. The first end is sized and shaped to rotatably engage the cylindrical recess. A cylindrical grommet is provided. The grommet has a first end, a second end, is formed of resilient, insulating material. The grommet is sized and shaped to fit slidably over the inner insulating layer of the cable. The grommet including a surrounding shoulder located between the first end and the second end. A washer is provided. The washer is sized and shaped to fit slidably over the first end of the grommet and bear against the surrounding shoulder. The coil spring is sized and shaped to surround the first end of the grommet and bear against the washer.

A spark plug lead button is provided. The button is fixedly and conductively attached to the center conductor of the cable adjacent the second end of the grommet. A cylindrical protector cap is provided. The cap is formed of insulating material and including an inner chamber and an external thread. The thread is size and shaped to engage the internal thread of the threaded nut.

In use, the protector cap is unthreaded from the threaded nut and the cable connector is inserted into a spark plug of an aircraft engine with the spark plug lead button bearing against a central spark plug conductor. When the threaded nut is threaded onto an external thread of the spark plug, the coil spring will be compressed, causing the spark plug lead button to bear against the central spark plug conductor, thereby providing a moisture-resistant connection between the cable and the sparkplug.

In a variant of the invention, the flexible, conducting, elbow tube is formed from a sheet of malleable metallic material. The sheet has first and second, opposed parallel edges and third and fourth, opposed parallel edges normal to the first and second edges. The sheet has a series of single, back to back folds parallel to the third and fourth edges and is formed about a cylindrical mandrel with a long axis of the mandrel perpendicular to the folds. The first and second edges are joined to form an open-ended cylindrical tube.

In a further variant, the flexible, conducting, elbow tube is formed from a sheet of malleable metallic material. The sheet has first and second, opposed parallel edges and third and fourth, opposed parallel edges normal to the first and second edges. The sheet has a series of single, back to back folds parallel to the third and fourth edges. Lower portions of the folds are doubled back upon themselves so as to provide four layers of metallic material adjacent a lower surface of the sheet. The sheet is formed about a cylindrical mandrel with the lower surface outermost with a long axis of the mandrel perpendicular to the folds. The first and second edges are joined to form an open-ended cylindrical tube that has a reinforced outer surface.

Yet another variant of the invention may be constructed from the following component. A radio-shielded ignition cable is provided. The cable has an outer insulating

cover, a shielding conductor, an inner insulating layer, and a center conductor. A flexible, conducting, elbow tube is provided. The elbow tube has a first end and a second end and is fixedly and conductively attached at its first end to the shielding conductor of the cable. The elbow tube is capable of retaining a particular shape after bending.

A sealing sleeve is provided. The sleeve joins the outer insulating cover to the first end of the elbow tube. A threaded nut is provided. The nut has a central orifice through it, a first end, a second end, a retaining lip at the first end and an internal thread extending from the second end toward the retaining lip. A conducting ferrule is provided. The ferrule being cylindrical in shape, having a central orifice though it, and having a body portion and a retaining portion.

The body portion has a first end and a second end and is sized and shaped to fit slidably through the orifice in the threaded nut. The body portion is fixedly and conductively attached at its first end to the second end of the elbow tube. The retaining portion has a first end and a second end. The first end extends from the second end of the body portion and is sized and shaped to bear rotatably against the retaining lip of the threaded nut. The second end of the retaining portion includes a cylindrical recess.

A cylindrical grommet is provided. The grommet has a first end, a second end, is formed of resilient, insulating material. The grommet is sized and shaped to fit slidably over the inner insulating layer of the cable. The grommet includes a surrounding shoulder located adjacent to the first end. The shoulder is sized and shaped to fit frictionally within the cylindrical recess in the second end of the retaining portion of the ferrule.

A spark plug lead button is provided. The button is fixedly and conductively attached to the center conductor of the cable adjacent the second end of the grommet. A cylindrical

protector cap is provided. The cap is formed of insulating material and includes an inner chamber and an external thread. The thread is size and shaped to engage the internal thread of the threaded nut.

In use, the protector cap is unthreaded from the threaded nut and the cable connector is inserted into a spark plug of an aircraft engine with the spark plug lead button bearing against a central spark plug conductor. When the threaded nut is threaded onto an external thread of the spark plug, the spark plug lead button will bear against the central spark plug conductor, thereby providing a moisture-resistant connection between the cable and the sparkplug.

The above variant may be used with either of the above-described flexible elbow tube designs.

Description of the Drawings

Figure 1 is an exploded side elevational view of the preferred embodiment of the invention including protective cap for a connector;

Figure 2 is a plan view of a folded, metallic sheet from which a first embodiment of a flexible, conducting, elbow tube is formed;

Figure 2a is perspective view of the **Figure 2** embodiment being formed about a mandrel;

Figure 2b is a side elevation of the first embodiment of a flexible, conducting, elbow tube;

Figure 2c is an enlarged, cross-sectional perspective of a section of the **Figure 2b** embodiment taken along the line **2c**;

Figure 3 is an exploded side elevational view of a second embodiment of the invention including protective cap for a connector;

Figure 3a is a plan view of the **Figure 3** connector and a sparkplug of the type attachable to said connector;

Figure 4 is a plan view of a folded, metallic sheet from which a second embodiment of a flexible, conducting, elbow tube is formed;

Figure 4a is perspective view of the **Figure 4** embodiment being formed about a mandrel;

Figure 4b is a side elevation of the first embodiment of a flexible, conducting, elbow tube;

Figure 4c is an enlarged, cross-sectional perspective of a section of the **Figure 4b** embodiment taken along the line **4c.**

Detailed Description of the Preferred Embodiment

Figure 1 illustrates an aircraft ignition cable connector **10** of the present invention that may be constructed from the following components. A radio-shielded ignition cable **14** is provided. The cable **14** has an outer insulating cover **18**, a shielding conductor **22**, an inner insulating layer **26**, and a center conductor **30**. A flexible, conducting, elbow tube **34** is provided. The elbow tube **34** has a first end **38** and a second end **42** and is fixedly and conductively attached at its first end **38** to the shielding conductor **22** of the cable **14**. The elbow tube **34** is capable of retaining a particular shape after bending.

A sealing sleeve **46** is provided. The sleeve **46** joins the outer insulating cover **18** to the first end **38** of the elbow tube **34**. A threaded nut **50** is provided. The nut **50** has a central

orifice **54** through it, a first end **58** , a second end **62**, a retaining lip **66** at the first end **58** and an internal thread **70** extending from the second end **62** toward the retaining lip **66**. A conducting ferrule **74** is provided. The ferrule **74** being cylindrical in shape, having a central orifice **78** though it, and having a body portion **82** and a retaining portion **86**.

The body portion **82** has a first end **88** and a second end **90** and is sized and shaped to fit slidably through the orifice **54** in the threaded nut **50**. The body portion **82** is fixedly and conductively attached at its first end **88** to the second end **42** of the elbow tube **34**. The retaining portion **86** has a first end **94** and a second end **98**. The first end **94** extends from the second end **90** of the body portion **82** and is sized and shaped to bear rotatably against the retaining lip **66** of the threaded nut **50**. The second end **98** of the retaining portion **86** includes a cylindrical recess **102**.

A coil spring **106** is provided. The coil spring **106** has a first end **110** and a second end **114**. The first end **110** is sized and shaped to rotatably engage the cylindrical recess **102**. A cylindrical grommet **118** is provided. The grommet **118** has a first end **122**, a second end **126**, is formed of resilient, insulating material. The grommet **118** is sized and shaped to fit slidably over the inner insulating layer **26** of the cable **14**. The grommet **118** including a surrounding shoulder **130** located between the first end **122** and the second end **126**. A washer **134** is provided. The washer **134** is sized and shaped to fit slidably over the first end **122** of the grommet **118** and bear against the surrounding shoulder **130**. The coil spring **106** is sized and shaped to surround the first end **122** of the grommet **118** and bear against the washer **134**.

A spark plug lead button **138** is provided. The button **138** is fixedly and conductively attached to the center conductor **30** of the cable **14** adjacent the second end **126** of the

grommet **118**. A cylindrical protector cap **142** is provided. The cap **142** is formed of insulating material and including an inner chamber **146** and an external thread **150**. The thread **150** is size and shaped to engage the internal thread **70** of the threaded nut **50**.

In use, the protector cap **142** is unthreaded from the threaded nut **50** and the cable connector **10** is inserted into a spark plug (not shown) of an aircraft engine (not shown) with the spark plug lead button **138** bearing against a central spark plug conductor (not shown). When the threaded nut **50** is threaded onto an external thread (not shown) of the spark plug, the coil spring **106** will be compressed, causing the spark plug lead button **138** to bear against the central spark plug conductor, thereby providing a moisture-resistant connection between the cable **14** and the sparkplug.

In a variant of the invention, as illustrated in **Figures 2, 2a, 2b** and **2c**, the flexible, conducting, elbow tube **34** is formed from a sheet **146** of malleable metallic material. As shown in **Figure 2**, the sheet **146** has first **150** and second **154**, opposed parallel edges and third **158** and fourth **162**, opposed parallel edges normal to the first **150** and second **154** edges. As shown in **Figure 2c**, the sheet **146** has a series of single, back-to-back folds **166** parallel to the third **154** and fourth **158** edges and is formed about a cylindrical mandrel **170** with a long axis **174** of the mandrel **170** perpendicular to the folds **166,** as illustrated in **Figure 2a**. As illustrated in **Figure 2b**, the first **150** and second **154** edges are joined to form an open-ended cylindrical tube **178**.

In a further variant, as illustrated in **Figures 4, 4a, 4b** and **4c**, the flexible, conducting, elbow tube **34** is formed from a sheet **182** of malleable metallic material. As shown in **Figure 4**, the sheet **182** has first **186** and second **190**, opposed parallel edges and third **194** and fourth

198, opposed parallel edges normal to the first **186** and second **190** edges. As shown in **Figure 4c**, the sheet **182** has a series of single, back to back folds **202** parallel to the third **194** and fourth **198** edges. Lower portions **206** of the folds **202** are doubled back upon themselves so as to provide four layers **210** of metallic material adjacent a lower surface **214** of the sheet **182**. The sheet **182** is formed about a cylindrical mandrel **218** with the lower surface **214** outermost with a long axis **222** of the mandrel **218** perpendicular to the folds **202** as illustrated in **Figure 4a**. As illustrated in **Figure 4b**, the first **186** and second **190** edges are joined to form an open-ended cylindrical tube **226** that has a reinforced outer surface **230**.

As illustrated in **Figures 3** and **3a**, yet another variant of the invention may be constructed from the following component. A radio-shielded ignition cable **234** is provided. The cable **234** has an outer insulating cover **238**, a shielding conductor **242**, an inner insulating layer **246**, and a center conductor **250**. A flexible, conducting, elbow tube **254** is provided. The elbow tube **254** has a first end **258** and a second end **262** and is fixedly and conductively attached at its first end **258** to the shielding conductor **242** of the cable **234**. The elbow tube **254** is capable of retaining a particular shape after bending.

A sealing sleeve **260** is provided. The sleeve **260** joins the outer insulating cover **238** to the first end **258** of the elbow tube **254**. A threaded nut **266** is provided. The nut **266** has a central orifice **270** through it, a first end **274**, a second end **278**, a retaining lip **282** at the first end **274** and an internal thread **286** extending from the second end **278** toward the retaining lip **282**. A conducting ferrule **288** is provided. The ferrule **288** being cylindrical in shape, having a central orifice **290** though it, and having a body portion **294** and a retaining portion **298**.

The body portion **294** has a first end **302** and a second end **306** and is sized and shaped to fit slidably through the orifice **270** in the threaded nut **266**. The body portion **294** is fixedly

and conductively attached at its first end **302** to the second end **262** of the elbow tube **254**. The retaining portion **298** has a first end **310** and a second end **314**. The first end **310** extends from the second end **306** of the body portion **294** and is sized and shaped to bear rotatably against the retaining lip **282** of the threaded nut **266**. The second end **314** of the retaining portion **298** includes a cylindrical recess **318**.

A cylindrical grommet **322** is provided. The grommet **322** has a first end **326**, a second end **330**, is formed of resilient, insulating material. The grommet **322** is sized and shaped to fit slidably over the inner insulating layer **246** of the cable **234**. The grommet **322** includes a surrounding shoulder **328** located adjacent to the first end **326**. The shoulder **328** is sized and shaped to fit frictionally within the cylindrical recess **318** in the second end **314** of the retaining portion **298** of the ferrule **288**.

A spark plug lead button **334** is provided. The button **334** is fixedly and conductively attached to the center conductor **250** of the cable **234** adjacent the second end **330** of the grommet **322**. A cylindrical protector cap **254** is provided. The cap **254** is formed of insulating material and includes an inner chamber **258** and an external thread **262**. The thread **266** is size and shaped to engage the internal thread **286** of the threaded nut **266**.

In use, the protector cap **254** is unthreaded from the threaded nut **266** and the cable connector **10** is inserted into a spark plug **340** of an aircraft engine (not shown) with the spark plug lead button **334** bearing against a central spark plug conductor (not shown). When the threaded nut **266** is threaded onto an external thread (not shown) of the spark plug, the spark plug lead button **334** will bear against the central spark plug conductor, thereby providing a moisture-resistant connection between the cable **234** and the sparkplug **340**.

The above variant may be used with either of the above-described flexible elbow tube **34, 254** designs. The aircraft ignition cable connector mechanism **10** has been described with reference to particular embodiments. Other modifications and enhancements can be made without departing from the spirit and scope of the claims that follow.

5

CLAIMS

1. An aircraft ignition cable connector, comprising:

a radio-shielded ignition cable, said cable having an outer insulating cover, a shielding conductor, an inner insulating layer, and a center conductor;

a flexible, conducting, elbow tube, said elbow tube having a first end and a second end and being fixedly and conductively attached at its first end to the shielding conductor of said cable;

said elbow tube being capable of retaining a particular shape after bending;

a sealing sleeve, said sleeve joining said outer insulating cover to the first end of said elbow tube;

a threaded nut, said nut having a central orifice therethrough, a first end, a second end, a retaining lip at said first end and an internal thread extending from said second end toward said retaining lip;

a conducting ferrule, said ferrule being cylindrical in shape, having a central orifice therethough, and having a body portion and a retaining portion;

said body portion having a first end and a second end and being sized and shaped to fit slidably through the orifice in the threaded nut and being fixedly and conductively attached at its first end to the second end of the elbow tube;

said retaining portion having a first end and a second end, said first end extending from the second end of the body portion and being sized and shaped to bear rotatably against the retaining lip of the threaded nut;

said second end of said retaining portion including a cylindrical recess;

a coil spring, said coil spring having a first end and a second end, said first end being sized and shaped to rotatably engage said cylindrical recess;

a cylindrical grommet, said grommet having a first end, a second end, being formed of resilient, insulating material and being sized and shaped to fit slidably over the inner insulating layer of the cable, said grommet including a surrounding shoulder disposed between said first end and said second end;

a washer, said washer being sized and shaped to fit slidably over the first end of the grommet and bear against said surrounding shoulder;

said coil spring being sized and shaped to surround the first end of the grommet and bear against the washer;

a spark plug lead button, said button being fixedly and conductively attached to the center conductor of the cable adjacent the second end of the grommet;

a cylindrical protector cap, said cap formed of insulating material and including an inner chamber and an external thread, said thread being size and shaped to engage the internal thread of the threaded nut; and

whereby, when the protector cap is unthreaded from the threaded nut and the cable connector is inserted into a spark plug of an aircraft engine with the spark plug lead button bearing against a central spark plug conductor and when the threaded nut is threaded onto an external thread of the spark plug, the coil spring will be compressed, causing the spark plug lead button to bear against the central spark plug conductor,

thereby providing a moisture-resistant connection between the cable and the sparkplug.

2. An aircraft ignition cable connector as described in Claim 1 wherein the flexible, conducting, elbow tube is formed from a sheet of malleable metallic material, said sheet having first and second, opposed parallel edges and third and fourth, opposed parallel edges normal to said first and second edges, a series of single, back to back folds parallel to said third and fourth edges, said sheet being formed about a cylindrical mandrel, a long axis of said mandrel being perpendicular to said folds, said first and second edges being joined to form an open-ended cylindrical tube.

3. An aircraft ignition cable connector as described in Claim 1 wherein the flexible, conducting, elbow tube is formed from a sheet of malleable metallic material, said sheet having first and second, opposed parallel edges and third and fourth, opposed parallel edges normal to said first and second edges, a series of single, back to back folds parallel to said third and fourth edges, lower portions of said folds being doubled back upon themselves so as to provide four layers of metallic material adjacent a lower surface of said sheet, said sheet being formed about a cylindrical mandrel with said lower surface outermost, a long axis of said mandrel being perpendicular to said folds, said first and second edges being joined to form an open-ended cylindrical tube having a reinforced outer surface.

4. An aircraft ignition cable connector, comprising:

a radio-shielded ignition cable, said cable having an outer insulating cover, a shielding conductor, an inner insulating layer, and a center conductor;

a flexible, conducting, elbow tube, said tube having a first end and a second end and being fixedly and conductively attached at its first end to the shielding conductor of said cable;

said elbow tube being capable of retaining a particular shape after bending;

a sealing sleeve, said sleeve joining said outer insulating cover to the first end of said elbow tube;

a threaded nut, said nut having a central orifice therethrough, a first end, a second end, a retaining lip at said first end and an internal thread extending from said second end toward said retaining lip;

a conducting ferrule, said ferrule being cylindrical in shape, having a central orifice therethough, and having a body portion and a retaining portion;

said body portion having a first end and a second end and being sized and shaped to fit slidably through the orifice in the threaded nut and being fixedly and conductively attached at its first end to the second end of the elbow tube;

said retaining portion having a first end and a second end, said first end extending from the second end of the body portion and being sized and shaped to bear rotatably against the retaining lip of the threaded nut;

said second end of said retaining portion including a cylindrical recess;

a cylindrical grommet, said grommet having a first end, a second end, being formed of resilient, insulating material and being sized and shaped to fit slidably over the inner insulating layer of the cable, said grommet including a surrounding shoulder disposed adjacent said first end, said shoulder sized and shaped to fit frictionally within the cylindrical recess in the second end of the retaining portion of the ferrule;

a spark plug lead button, said button being fixedly and conductively attached to the center conductor of the cable adjacent the second end of the grommet;

a cylindrical protector cap, said cap formed of insulating material and including an inner chamber and an external thread, said thread being size and shaped to engage the internal thread of the threaded nut; and

whereby, when the protector cap is unthreaded from the threaded nut and the cable connector is inserted into a spark plug of an aircraft engine with the spark plug lead button bearing against a central spark plug conductor and when the threaded nut is threaded onto an external thread of the spark plug, the spark plug lead button will bear against the central spark plug conductor, thereby providing a moisture-resistant connection between the cable and the sparkplug.

5. An aircraft ignition cable connector as described in Claim 4 wherein the flexible, conducting, elbow tube is formed from a sheet of malleable metallic material, said sheet having first and second, opposed parallel edges and third and fourth, opposed

parallel edges normal to said first and second edges, a series of single, back to back folds parallel to said third and fourth edges, said sheet being formed about a cylindrical mandrel, a long axis of said mandrel being perpendicular to said folds, said first and second edges being joined to form an open-ended cylindrical tube.

6. An aircraft ignition cable connector as described in Claim 4 wherein the flexible, conducting, elbow tube is formed from a sheet of malleable metallic material, said sheet having first and second, opposed parallel edges and third and fourth, opposed parallel edges normal to said first and second edges, a series of single, back to back folds parallel to said third and fourth edges, lower portions of said folds being doubled back upon themselves so as to provide four layers of metallic material adjacent a lower surface of said sheet, said sheet being formed about a cylindrical mandrel with said lower surface outermost, a long axis of said mandrel being perpendicular to said folds, said first and second edges being joined to form an open-ended cylindrical tube having a reinforced outer surface.

ABSTRACT

An aircraft ignition cable connector includes a radio-shielded ignition cable. The cable has an outer insulating cover, a shielding conductor, an inner insulating layer, and a center conductor. The cable is encased in a flexible, conducting, elbow tube. The elbow tube is attached at one end to the shielding conductor of the cable and attached at the other end to a metallic ferrule held to a threaded spark plug by an internally threaded nut. The elbow tube is capable of retaining a particular shape after bending. The elbow tube is formed from a sheet of malleable metallic material. The sheet has first and second, opposed parallel edges and third and fourth, opposed parallel edges normal to the first and second edges. The sheet has a series of single, back-to-back folds parallel to the third and fourth edges and is formed about a cylindrical mandrel with the long axis of the mandrel perpendicular to the folds. The first and second edges are joined to form an open-ended cylindrical tube that is shaped into the elbow. In a variant of the invention, lower portions of the back-to-back folds are doubled back upon themselves so as to provide four layers of metallic material adjacent the lower surface of the sheet. The sheet is formed about a cylindrical mandrel with the lower surface outermost with the long axis of the mandrel perpendicular to the folds. The first and second edges are joined to form an open-ended cylindrical tube that has a reinforced outer surface.

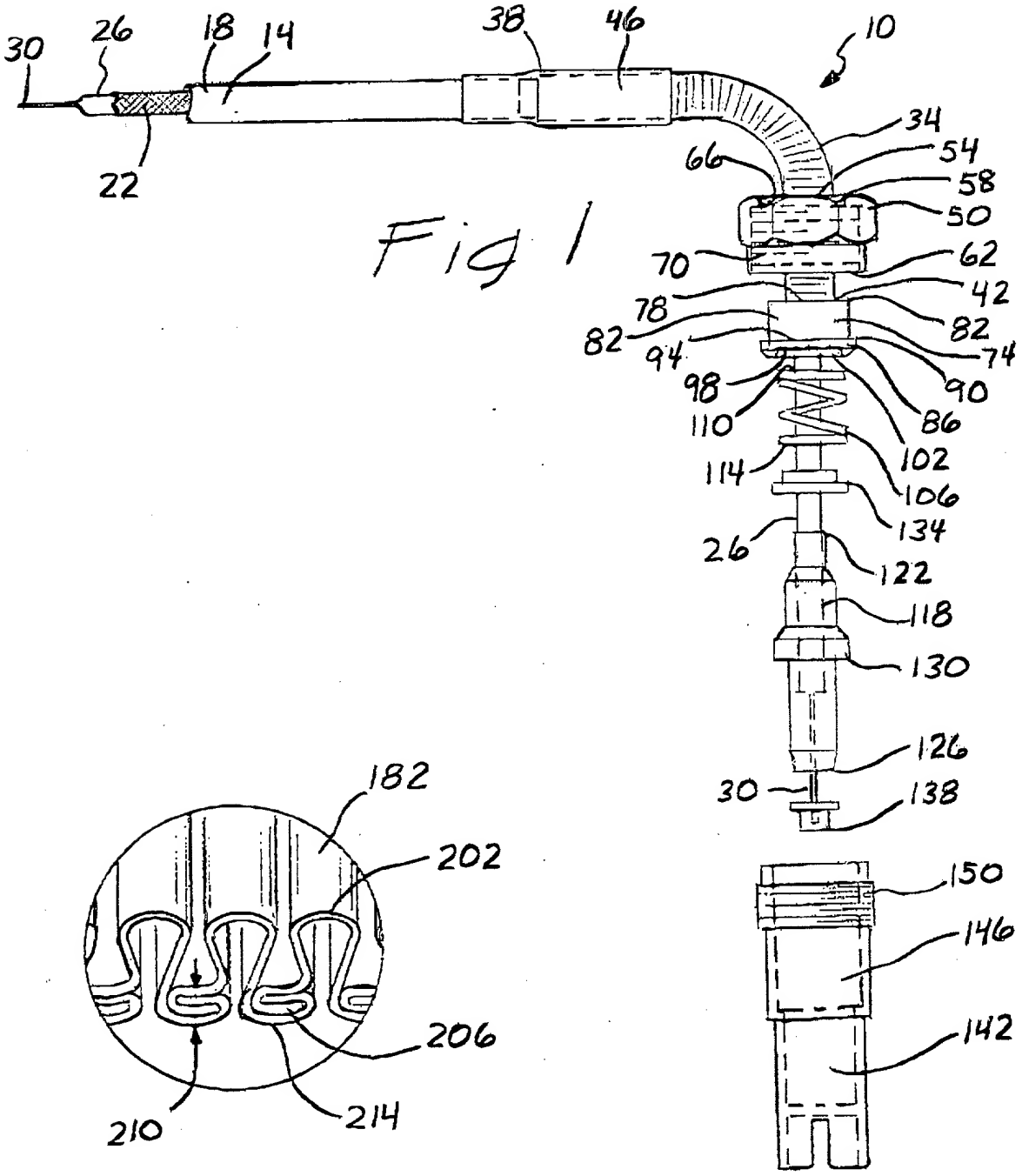
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Fig 1

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Fig 4C

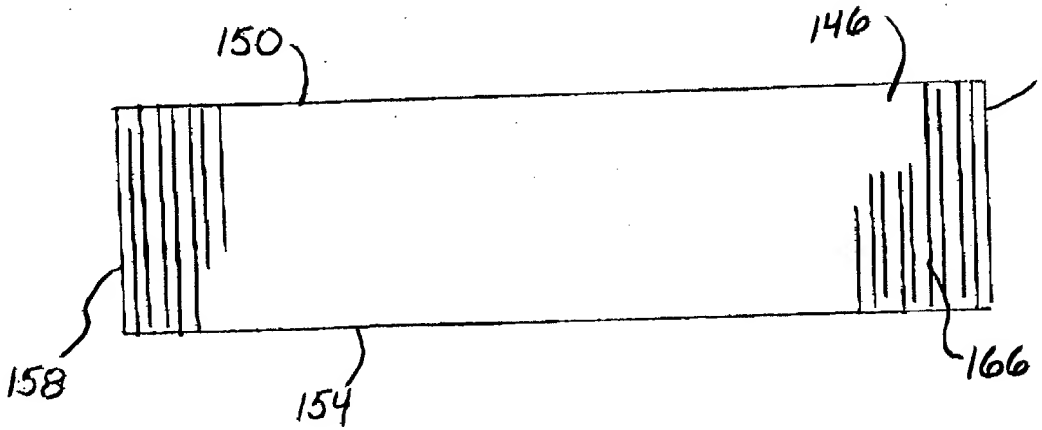

Fig 2

Fig 2a

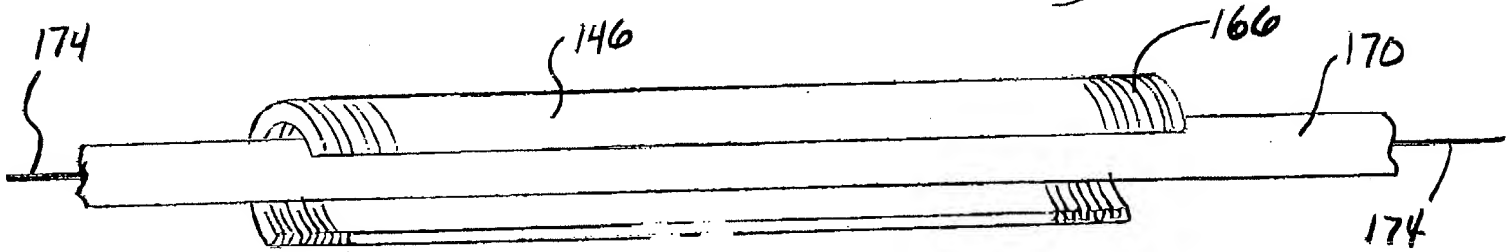

Fig 2b

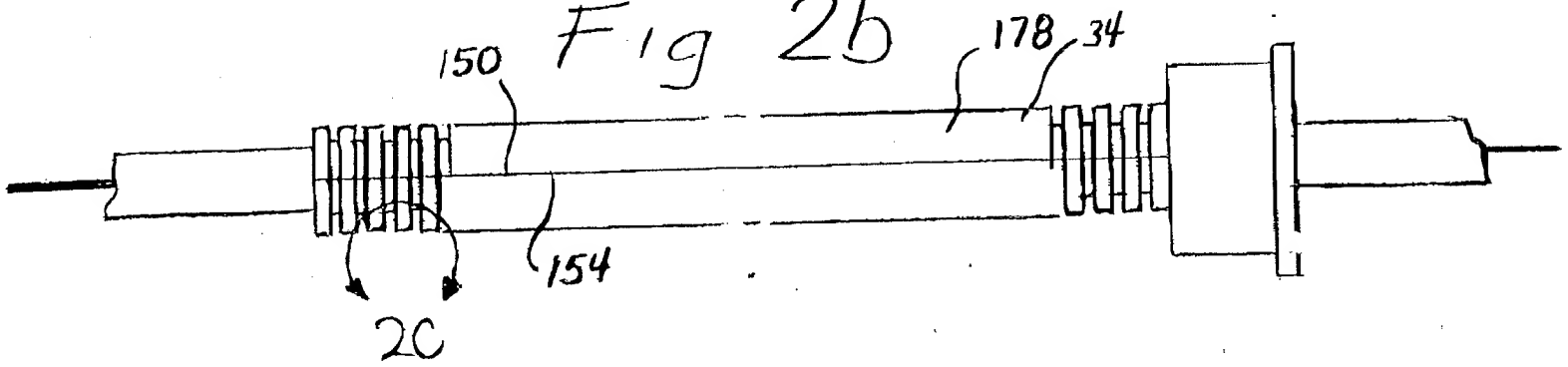

Fig 3

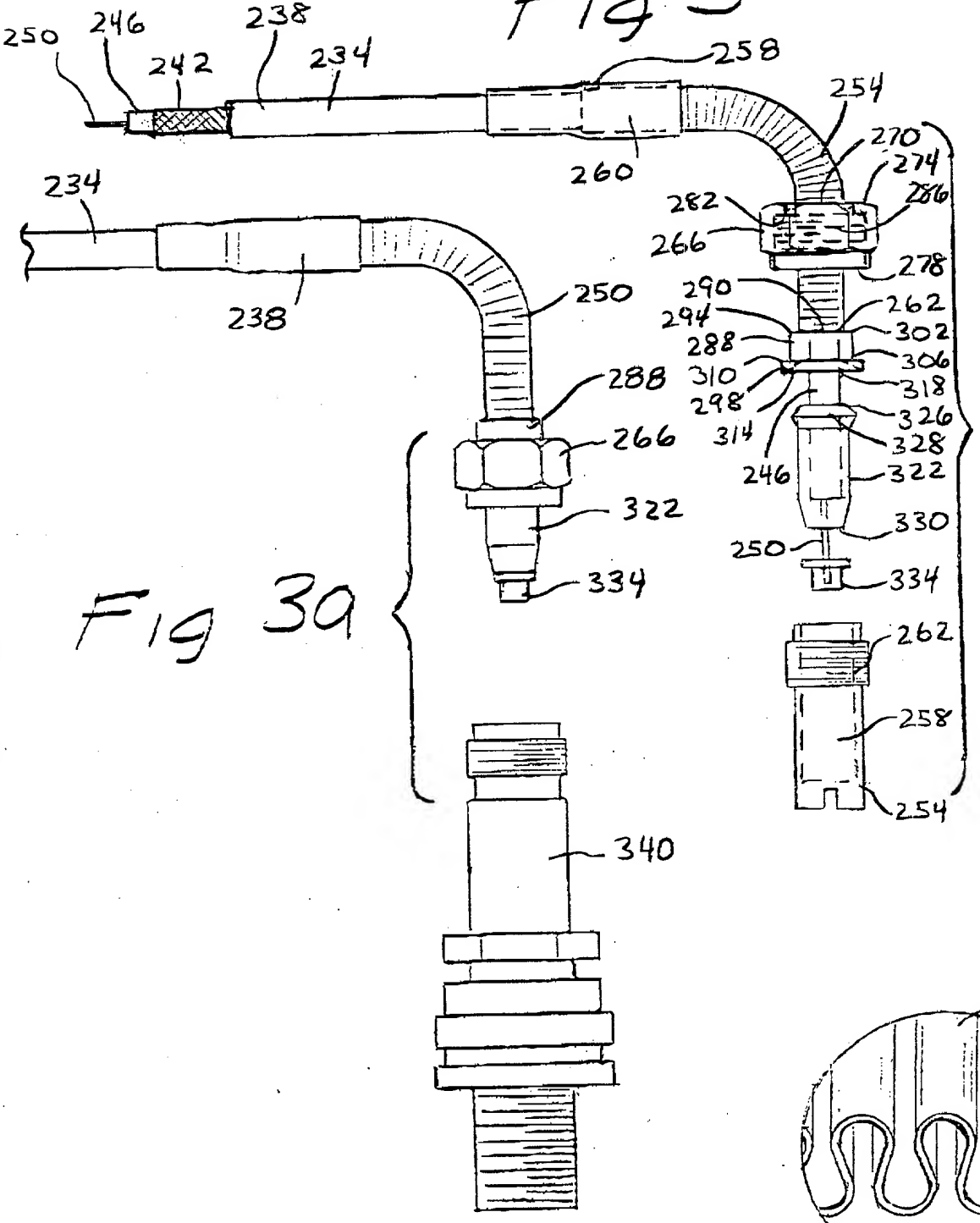

Fig 3a

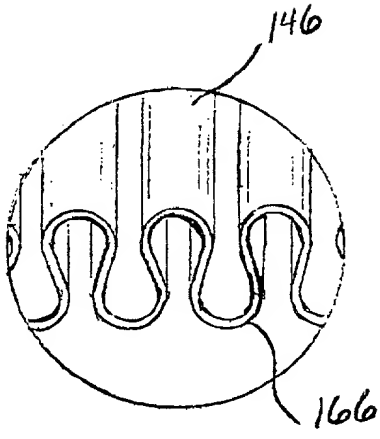

Fig 2c

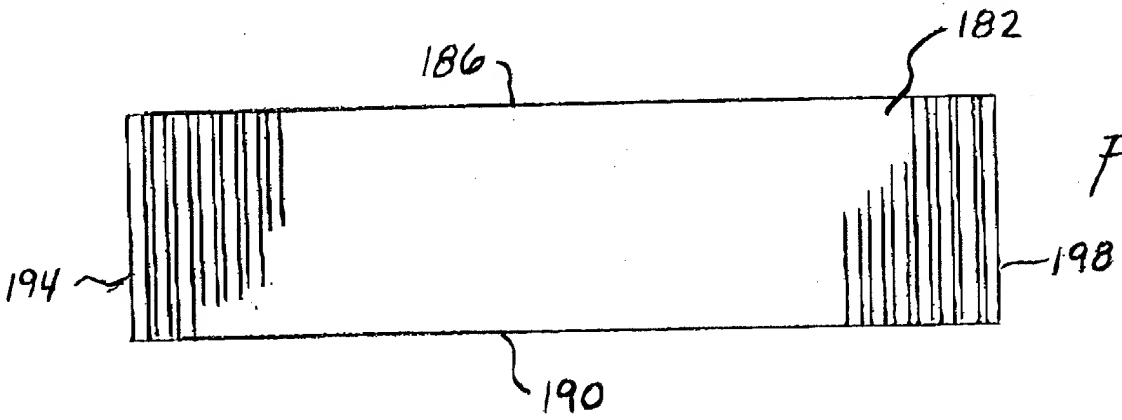

Fig 4

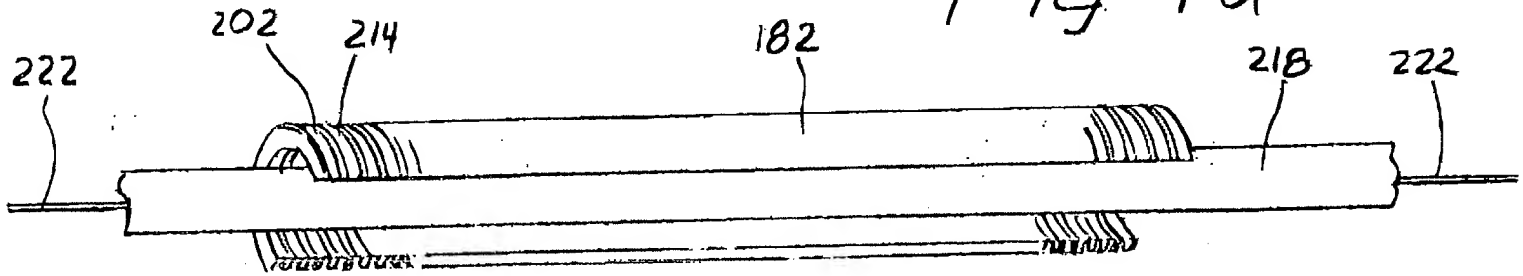

Fig 4a

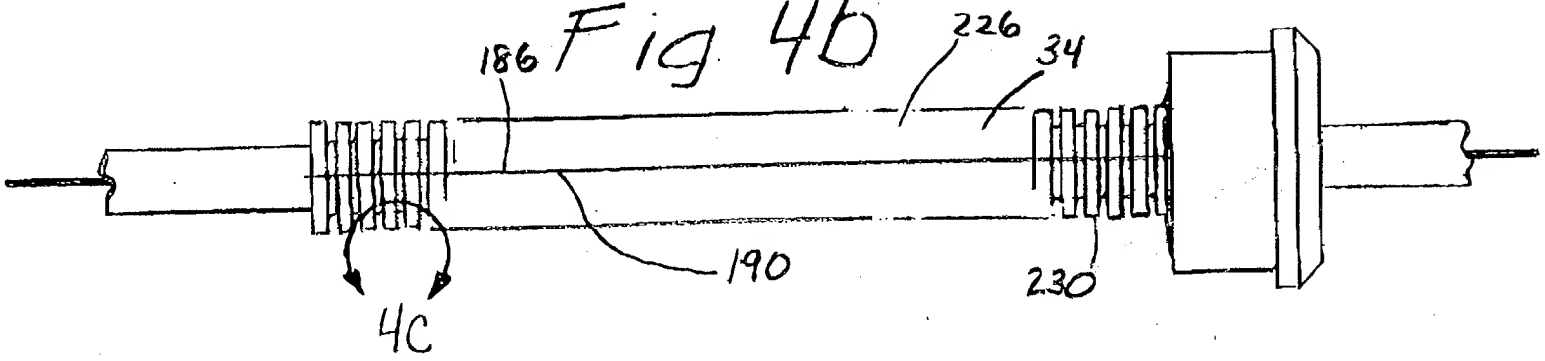

Fig 4b

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☒ Declaration Submitted with Initial Filing OR ☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	R061-P
First Named Inventor	HOWARD R. JOHNSON
COMPLETE IF KNOWN	
Application Number	
Filing Date	Filed herewith
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

AIRCRAFT IGNITION CABLE CONNECTOR

(Title of the Invention)

the specification of which
☒ is attached hereto
OR
☐ was filed on (MM/DD/YYYY) _____ as United States Application Number or PCT International Application Number _____ and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
None			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
None		

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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OR

☒ Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number
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Natan Epstein	28,997	Todd B. Serota	31,421
Robert Jacobs	33,403		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
HOWARD R.	JOHNSON

Inventor's Signature	Howard R Johnson					Date	8-24-00
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Post Office Address							
City	El	State	CA	ZIP	90245	Country	U.S.A.

☐ Additional inventors are being named on the ___ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto